Exhibit H

Journal of Regulatory Economics; 14:281-304 (1998)

MERGERS IN REGULATED INDUSTRIES: THE USES AND ABUSES OF EVENT STUDIES[1]

ALAN J. COX
National Economic Research Associates, Inc.
444 Market Street, San Francisco, CA 94111
E-mail: alan.cox@nera.com

JONATHAN PORTES
National Economic Research Associates, Inc.
1166 Avenue of the Americas, New York, NY 10606
E-mail: jonathan.portes@nera.com

Abstract
Merging utilities are frequently required to share the economic benefits of a merger with ratepayers. These benefits are often measured using stock price movements at the time of the merger announcement. While event studies of this sort can be a powerful and appropriate tool, improper application and interpretation can lead to misleading conclusions. In this paper, we review the basic event study approach to merger evaluation and discuss some of the complicating factors. We describe both flawed and correctly done event studies submitted in the merger application of SBC Communications and Pacific Telesis and some additional case studies.

1. Introduction

On April 1, 1996, SBC Communications, Inc. (SBC) and Pacific Telesis Group (PacTel) announced their intention to merge. That day, PacTel's stock price closed at $33.75, more than 20 percent higher than its previous close. The value of PacTel's equity had risen by almost $2.6 billion in one day. SBC stock, on the other hand, declined in value on the day of the announcement, closing at $49.875; its equity value fell by about $1.685 billion.

In order for this merger to be consummated, it had to be approved by the California Public Utilities Commission (CPUC) under Section 854 of the California Public Utilities Code. Subsection (b) of the code requires the CPUC to find that a proposed merger does not

---

1 A longer version of this paper is available from the authors. Comments are welcome. We would like to thank Thomas Yu for very able research assistance. We are grateful for the comments of the editor, two anonymous referees, and to NERA colleagues James Forcier, Marcia Kramer Mayer and David Tabak for helpful reviews of earlier drafts.

adversely affect competition and that it provides benefits in both the long run and the short run. It also requires the Commission to equitably allocate these benefits between the shareholders and ratepayers where the Commission has ratemaking authority. If such an allocation is required, ratepayers must receive at least one half of the benefits.

The United States Department of Justice found that the merger did not violate federal antitrust laws and the Attorney General of California found that the merger would not adversely affect competition in any relevant market. However, the 854(b) provision of the statute, requiring a sharing of the benefits of the merger, was a major point of contention. The greatest controversy arose over estimates of the size of the saving that would be created in California and over the allocation of those savings.

Applicants provided an estimate of the savings directly attributable to the merger itself by determining the cost of redundancies that could be eliminated and returns to scale that could result from the merger.[2] Intervenors offered alternative estimates of savings. Intervenors included the Office of Ratepayer Advocates, a department of the CPUC, and Towards Utility Rate Normalization (TURN), a non-government public advocacy and intervenor group. Some of these estimates were based upon confidential estimates of investment bankers advising PacTel and SBC on the benefits of the merger and their forecasts of future cash flow. However, each intervenor witness offered estimates based on the increase in PacTel's stock price, claiming that this represented "the total benefit that shareholders perceive as obtaining from a merger."[3] Of course, such calculations, contrary to normal event study methodology, ignore the effect of the merger announcement on the price of SBC stock.

This episode is hardly surprising. Deregulation has spurred a sharp increase in the number of mergers in the telecommunications, electricity and natural gas industries. Frequently, news of a proposed merger is associated with sharp changes in the market capitalization of one or both companies. It may also affect the valuation of other companies in the same industry. In the regulatory review of these mergers, both applicants and intervenors have attempted to draw substantive conclusions from these price movements and changes in other financial variables. In particular, parties have argued that event study analysis can be used to infer the existence and magnitude of net economic benefits resulting from a merger, the benefits to shareholders or ratepayers, the effect on competition, and the appropriateness of a ratepayer sharing mechanism.

The theoretical basis for event study analysis is the semi-strong version of the Efficient Markets Hypothesis. This hypothesis states that all publicly available information is incorporated into stock prices. This simple concept provides a powerful tool for evaluating mergers, takeovers and other corporate events. By attributing otherwise unexplainable changes in stock prices to specific new information, event study analysis allows that new information to be "valued." Valuations produced by these methods are based upon information that results from the interactions of numerous self-interested and presumably rational economic agents in financial markets. They are thus less prone to individual bias and far

---

2 This estimate excluded savings that could be implemented without the merger, such as the incorporation of best practice techniques in providing service.

3 Direct Testimony of Terry L. Murray on behalf of Towards Utility Rate Normalization, *In the Matter of the Joint Application of Pacific Telesis Group and SBC Communications, Inc.* before the Public Utilities Commission of the State of California, Application No. 96-04-038, September 30, 1996, p. 29.

less reliant on dubious or questionable assumptions than valuations produced through such alternative methods as discounted cash flow analysis. In this paper, we discuss the uses—and potential abuses—of event study analysis in examining mergers in regulated industries.

We argue that while event study analysis is a potentially useful and powerful tool, it should be used with care. Often, the conclusions drawn from its use are overreaching. In this paper, we first review the basic event study approach to merger evaluation. In the cases that we will be analyzing, the relevant event is the announcement of a merger and the relevant variable is usually the combined market value of the merging companies. We review the theoretical basis for such studies and describe the basic conclusions that can be drawn under a variety of circumstances.

We then describe some complicating factors that must be considered. These include the timing and nature of the information actually available to the stock market; the change in the market's assessment, both before and after the announcement, of the probability of a merger; the impact of deregulation and increased competition; the period over which benefits and synergies, if any, are to be recognized; and the variety of bargaining solutions that may be reached depending on the relative effectiveness of the merging firms' managements in negotiating a deal.

Finally, we apply this approach to merger announcements in recent cases in the energy and telecommunications industries, including the SBC/PacTel merger. We describe the conclusions that in general could—and could not—legitimately be drawn from stock price movements in these cases.

2. The Efficient Market Hypothesis and Event Study Analysis

2.1. The Efficient Market Hypothesis

2.1.1. Definition and Description of the Theory

The Efficient Market Hypothesis (hereafter EMH), in its various versions, is one of the most important concepts in modern financial economics. It is not a recent concept, dating back to at least 1967.[4] However, its use in other areas of empirical economics, and in legal and regulatory proceedings, is a more recent innovation. "Event studies" using the EMH as their theoretical underpinning have been used to evaluate the economic effects of events as disparate as airline crashes and the deregulation of the trucking industry (Rose 1985). Indeed, the EMH is one of the few economic propositions to have received the imprimatur of the Supreme Court.[5]

The semi-strong version of the EMH states that in an efficient market, "market prices reflect all publicly available information"[6] and "respond quickly and without bias to new information" (Cornell and Morgan (1990). Thus, if the EMH holds, the stock price of any company at any time reflects the market's best estimate, based on publicly available information, of the present discounted value of the cash flows from that company. If new information becomes available to the market, then the stock price of that company will adjust

4 This date is cited in Malkiel (1987). Malkiel states that the division of market efficiency into the weak form, the semi-strong form and the strong form are generally attributed to Roberts (1967).

5 *Basic v. Levinson*, 485 U.S. 224, 241 (1988).

6 See Brealey and Myers (1995, 306).

to reflect the market's new estimate of that discounted present value.

The basis for the EMH is an arbitrage argument; if market prices diverged systematically from the market's best estimate of value, then it would be possible to profit from this divergence. For example, suppose market prices systematically failed to reflect the impact of quarterly earnings announcements as soon as they were released. Then it would be possible to make money consistently by buying or selling stocks of companies immediately after their earnings announcements, and waiting for the full impact of the announcement to be reflected in stock prices. In fact, in an "efficient" market, in the semi-strong sense, any such opportunities for riskless profit will be arbitraged away more or less immediately.

Note that the EMH may hold even though the market includes many purchasers of stock who may be wholly or largely ignorant of the relevant information, let alone its effects and implications. It may seem counterintuitive that the opinion of average market participants should be accorded equal weight to the views of knowledgeable market and industry analysts, investment bankers, or the like. However, if it were the case that investment bankers, stock market analysts, astrologers or anyone else were a better judge of the prospects of a company than the market as a whole, then it would be possible to construct a trading strategy that would enable investors to make supernormal profits by trading on the basis of such judgments.[7]

2.1.2. Evidence for the EMH

There is now a "vast body of evidence supporting the semi-strong EMH. The evidence in favor of the market's rapid adjustment to new information is sufficiently pervasive that it is now a generally, if not universally, accepted tenet of financial econometric research" (Malkiel 1987). This substantial empirical evidence dates back to at least the mid-60s.[8] Since these papers were published, there have been literally hundreds of finance papers confirming the general conclusion that the United States stock market is semi-strong efficient.[9]

This is not to say that all financial markets are perfectly efficient at all times. To be efficient, a market needs to meet at least some conditions. Some of those that have been described as necessary include the following: that the stock in question be widely held, actively traded, followed by several analysts, and that fundamental information about the company be widely available. Researchers have also identified a number of so-called "anomalies." For example, there is apparently a degree of persistent overperformance of small company stocks in the month of January. Others have suggested that, under some circumstances, the market can either overreact or underreact to an event.[10] However, the

7 Indeed, it has been argued that even those who have access to *non-public* information cannot systematically make supernormal profits, because the very attempt to capitalize on such information—by buying or selling stocks—will tend to reveal the significance of such information. However, this extreme version of the EMH—known as the "strong" EMH—has little empirical support. In practice, illegal insider trading has frequently proven profitable.

8 For example, see Fama (1965) and Fama, Fisher, Jensen, and Roll (1969).

9 See Brealey and Myers (1995, 306-8).

10 Indeed, the Private Securities Litigation Reform Act of 1995 contains a provision that effectively requires the event window in private securities litigation cases to be 90 days. This was apparently in response to suggestions that because markets overreact to bad news, a one-day event window would tend to overestimate damages. For a description of the rationale and potential impact of the "bounce-back provision," see Dickey and Mayer (1996).

existence and significance of these anomalies are controversial and subject to much statistical debate.[11] Most importantly, the very research that identifies such anomalies is likely to contribute to their destruction, since it suggests the existence of profitable trading strategies not yet exploited. Market participants are likely to attempt to implement such strategies, and, by so doing, arbitrage them away.

2.1.3. Limits to Inferences that Can Be Drawn from the Semi-strong Form of the EMH

The semi-strong version of the efficient market hypothesis merely states that stock prices react quickly and in an unbiased manner to new information. Such price changes may have nothing to do with fundamentals. Another important caveat that is frequently ignored is that the EMH does *not* mean that the market is always right; it merely means that the market is not *systematically* wrong. The market does not know today with certainty what precisely the effect of a given event will be. *Ex post*, the market's estimate of the effect of the event is likely to be wrong, because it is indeed just that—an estimate. All the EMH suggests is that the market's estimate is not systematically biased; in other words, that today's market estimate incorporates all publicly available information, today. Tomorrow, and the next day, new information will come along, and the market will adjust its estimate accordingly.

2.2. The Event Study Approach

2.2.1. What Is an Event Study?

If the EMH holds, it is possible to infer the market's estimate of the change in the discounted present value of a company's future cash flows resulting from a particular event by observing the change in that company's stock price when news of that event reaches the market. The change in the market's valuation should, in principle, reflect the market's estimate of the effect of that event on the discounted present value of the future cash flows of that company.

This is a very powerful result. Consider the surprise announcement of a new product by a company. The change in the market value of the company that occurs as a result of the announcement is the *single best estimate*, based on publicly available information, of the impact of that product on the future profits of the company. This estimate incorporates everything relevant to that effect—the chance that the product will turn out to be unworkable or difficult to market or unpopular, as opposed to the chance that it will be a runaway success, the effect of the existence of the product on the likelihood that the company will be taken over, the appropriate discount rate, and so on.

However, this is not the end of the story. If the new product announcement provides other information about the company, it may change the assessment that the market makes of the company. For instance, if the degree of innovation is a surprise to the market, the announcement may induce a reassessment by the market of the value of the company's entire research and development program. On the other hand, the market may have known this company to be generally innovative or to have undertaken some pathbreaking product development programs. In that case, the market may already have anticipated the new product, and the stock price may adjust by less than the expected total impact on future profits.

---

11 See, for example, Keim (1986).

This use of financial market valuations to estimate the impact of an event is usually referred to as an "event study." We now review the basic methodology of event studies.

2.2.2. Standard Event Study Methodology

The basic principle is extremely simple. The sequence of events might be that, after the stock market closes on a given day, the company announces some totally unexpected news. Let $t = 0$ represent the closing time of the market just before the announcement, and let P_0 represent the stock market valuation of the company of interest at $t = 0$. The next day, trading resumes and the stock price changes in response to the news. Suppose, at time $t = 1$, (after a full day of trading), the stock closes at price P_1. In general, if the semi-strong form of the EMH holds, $P_1 - P_0$ provides an estimate of the effect of the event of interest on the per-share value of the company.

Two complications arise with this simple analysis:

- The time period over which to measure the impact of the event. In the formulation above, a one-day time period was used. An ideal scenario would have the change in price occur *immediately* after the announcement; in practice, since prices do not change continuously and because even in the most efficient markets traders require some time to react to news, there must be some finite interval between $t = 0$ and $t = 1$.
- How to ensure that only the influence of the event in question is measured, and not that of other extraneous events or information. Since some finite time must elapse between $t = 0$ and $t = 1$, other events may—and in practice will—occur, and these events may contribute to the change in the market's valuation of the company. Such events will tend to contaminate our estimate of the effect of the event.

Thus, there is a trade-off between using longer and shorter time horizons. In the economic literature, the one-day reaction is frequently used. However, there does not appear to be any sound empirical basis for choosing one day as the time period that minimizes the sum of the errors such as those mentioned above.

2.2.3. Market Model

Even a one–day period is long enough for significant extraneous events to influence the market price of a stock. It is therefore necessary to attempt to control for such events. This is usually done utilizing a "market model" based on a version of the standard capital asset pricing model. Using data from the period prior to the event, a regression is performed of the company stock returns on the returns earned on a market index portfolio and (possibly) an industry index portfolio. For instance, we can estimate α, β, and γ in the equation:

$$r_t = \alpha + \beta \cdot rm_t + \gamma \cdot ri_t,$$

where r_t is the return on the stock on day t, α is the intercept term, rm_t is the return on a portfolio of widely held stocks on day t and ri_t is the return on a portfolio of stocks in the same industry as the merging companies on day t.

This allows us to predict the expected return on the company's stock in the absence of any unusual company-specific information. We estimate what the return would have been on the day after the event, had the event not occurred. Call this $E(r_1)$.[12] The "excess" return

12 If α', β', γ' represent the estimated values of α, β, γ, then $E(r_1) = \alpha' + \beta' rm_1 + \gamma' ri_1$.

for a particular stock on day one is the actual return minus the predicted return, or $r_1 - E(r_1)$. This provides, in general, a more accurate estimate of the change in the value of the stock that is attributable to the event, provided there is no other company-specific information that the market received on day one.[13] A more detailed description of the methodology is given in the case studies below.[14]

3. Applications of Event Study Analysis To Mergers In Regulated Industries

3.1. Event Studies and Mergers

3.1.1. Estimating the Expected Gains from a Merger

An event study can help to answer a number of questions that arise in mergers.[15] The first is the question of whether the merger is expected to result in efficiency gains or synergies; such gains include economies of scale and scope, vertical coordination, and the benefits resulting from joining complementary assets or skill bases. Consider a merger that is expected to result in such synergies. Call the purchasing company Company A and the target company Company B. The market values of Company A and Company B before the merger announcement are V_A and V_B. Call the additional value that is created as a result of the synergies that arise from the merger V_{AB}. In that case the new, merged company is worth:

$$V_m = V_A + V_B + V_{AB}.$$

What will an event study tell us in this case? Since the stocks of the two companies, taken together, will eventually represent the stock of the merged company, the combined values of the two companies after the announcement should add up to V_m. This is the best market estimate of the value of the merged firm. This approach is well recognized in economic literature:

> How might we test for the presence of operating synergy [i.e., economic benefits for shareholders]? If one or more sources of synergy are operative, and investors realize this, the post-acquisition shareholder market value of the combined firm should exceed the sum of the pre-acquisition values of the individual corporations. An *event study* of stock price response to the announcement of a planned acquisition should result in positive cumulative abnormal returns taking into account both the acquiring and target companies. (Gibson and Black 1995, 299) (Citations omitted).

A substantial number of studies use event study analysis to evaluate the gains from mergers.[16]

---

13 There may, for instance, be additional items that effect a geographically distinct group of companies that would not have been fully reflected in the change in the value of the index. Such precautions do not exhaust the list of caveats that might be appropriate to take into account before undertaking such an analysis.

14 There are a number of more complex methodological issues relating to event studies not discussed here. See, for example, Giaccotto and Sfiridis (1996).

15 The subsequent discussion draws on McGuckin, Warren-Boulton, and Waldstein (1992). Event study analysis is used to determine the impact of mergers of firms that are described as competitors in Eckbo (1983). For a critique of the Eckbo analysis, see Werden and Williams (1989).

16 An alternative explanation would be that the announcement of the bid reveals new information about the value of the target. However, this does not appear to be supported empirically. See Bradley, Desai, and Kim (1983).

3.1.2. The Distribution of Gains

The above analysis suggests that gains resulting from the merger can be evaluated by looking at the combined effect on the two merging companies. But what do the individual values of the two companies tell us? The answer is that they relate only to the *distribution* of such gains between the shareholders of the two companies.

Returning to the formulation above, Company A should be willing to pay up to $V_B + V_{AB}$ for Company B, less any costs of undertaking the transaction. However, shareholders of Company B should be willing to sell the company for any amount greater than V_B.[17] Hence, the outcome is not predetermined. The price paid for the target firm will reflect any gains to its shareholders that result from successful bargaining by its management. In principle, it is possible for one side to appropriate *all* the benefits of the merger. The relative effects of the merger announcement on the stock prices of the individual companies may therefore provide useful information on the results of this bargaining game between managements, and hence on the relative benefits accruing to shareholders. The relative effects of the announcement on the two company's stock prices may also provide information on the bargaining strength of the two companies. However, it is not possible to evaluate the overall efficiency gains from a merger simply by looking at the stock price performance of either the target firm or the acquiring firm in isolation.

A further, more subtle point, but one particularly relevant to regulated industries, is that the distribution of gains or losses between the two companies' *shareholders* tells us little about the distribution of economic benefits between their *businesses*. For instance, if a California electric utility announces a merger with a Nevada electric utility, and the stock price of the California company increases while that of the Nevada utility remains constant, we may conclude, all else being equal, that the merger is expected to produce economic benefits to shareholders of the merged company. However, we cannot conclude that those benefits are expected to accrue in California rather than Nevada; it could be in either or both. All we know is that the shareholders of the California company appear to have benefited more from the deal than shareholders of the Nevada utility.

3.1.3. Changes in the Degree of Competition Resulting from a Merger

The analysis described above can be used to determine whether the merger is likely to result in "business value gains," but it alone cannot determine whether such gains arise because of expected synergies and other efficiencies, or because the merger results in a significant increase in market power. That is, analysis of price changes of the stocks of the single company cannot tell us whether two firms, merged, are more efficient at producing, distributing and marketing their products, or whether the merger will result in the new firm being able to profitably raise the prices of the products both produce. Clearly, these two effects will have very different impacts on product prices and consumer welfare and, hence, have different regulatory and antitrust implications.

However, event studies can, under certain conditions, provide some evidence to distinguish between these two hypotheses, by studying stock price movements of firms which compete with the merging companies in the relevant markets or are likely potential competitors. Suppose that, during the event window, stock prices of competitors fall while the

17 The principles are the same for a merger that will be consummated by an exchange of stock.

combined value of the merging companies rise. One interpretation of this result is that the merger may be expected to result in greater efficiency. Generally, such an increase in efficiency will induce the merging firm to reduce its prices in an attempt to increase sales and market share. In turn, that will result in downward pressure on competitors' prices and competing firms would expect to see margins and profits reduced.

On the other hand, prices of competitors' stocks may rise along with the combined value of the merged firm during the event window. Such an increase in the market values of all firms may mean that concentration in the relevant antitrust market has increased. Such an increase in market prices of all firms may be due to an increase in the ability of firms in the relevant antitrust market to explicitly or implicitly coordinate production and pricing decisions. In that case, the merger will increase prices and competing firms will experience a windfall gain in profits (either because they will leave prices unchanged, and experience an increase in demand, or because they will also raise prices).[18]

Such results need to be interpreted with considerable care. For instance, a merger announcement may indicate that other firms in the industry may also be merger targets in the future. Their stock prices may rise because market analysts believe that there may be other opportunities to capture synergies or because they are undervalued. As we describe below, this is what may have happened in the SBC Communications (SBC) merger with Pacific Telesis Group (PacTel). In such a situation, it would be wrong to conclude that a rise in the value of competing firms reflected an expected reduction in competition in the relevant market. If the merger announcement results in an increase in market capitalization of both merged firm and its competitors, it is probably necessary to undertake an analysis of the competitive conditions in the relevant antitrust market within which the firm operates.[19]

Some of the feasible outcomes, and possible economic interpretations, are shown in table 1. It is important to emphasize that these are only possible interpretations of the outcome of event studies of merger announcements.

4. Event Studies in Regulated Industries

4.1. Advantages

The above discussion shows that event studies can be useful in merger analysis. There are also a number of reasons why they could, in principle, be particularly useful in the analysis of regulated industries. First, we should note that event study analysis may be particularly attractive to regulators, because it appears to solve problems of asymmetric information. Regulators typically know considerably less about the firms they regulate than management of those firms. In the adversarial context in regulatory proceedings, this problem can extend beyond the regulated firms themselves to their potential competitors, consumer and ratepayer advocates, who may also have an incentive to supply regulators with information that is less

---

18 This will be true even in the case of "unilateral effects" as long as there exists any significant cross-elasticity between the products on which prices are raised and other products.

19 A generally appropriate methodology for defining relevant antitrust markets and criteria for determining whether there is a danger that market power may be exercised is described in the 1992 *Horizontal Merger Guidelines* issued jointly by the Antitrust Division of the Department of Justice and the Federal Trade Commission. The guidelines were reissued in April 1997 to describe the manner in which the Agencies will incorporate efficiency gains into its analysis of proposed mergers.

Table 1

Value of Merging Companies*	Value of Competing Companies	Some Possible Economic Interpretations of Market's Valuation
Increase	Increase	Reduced competition, higher prices, lower consumer welfare or no change in competitive conditions but re-evaluation by market
Increase	Decrease	Increased efficiency of merged firm, lower prices, higher consumer welfare
Decrease	Increase	Decreased efficiency in merged firm, higher prices, reduced competition, lower consumer welfare
Decrease	Decrease	Increased competition, lower prices, higher consumer welfare or no change in competitive conditions but re-evaluation by market

*Changes in the value of merging companies and of competing companies are net of market effects.

than perfect.

Regulators' frequent reliance on detailed accounting data to assess a utility's performance provides an example of the informational difficulties that regulators face. Often, the historic cost data tracked by accountants is of limited relevance to "real" economic variables. For example, there is often little correlation between accounting profits and economic profits. Book values may also vary widely from economic value. This problem can be circumvented by the use of discounted cash flow analysis (DCF). But DCF is often highly sensitive to the choice of discount rate and assumptions about what will happen in the future, thus making it difficult to apply with any degree of certainty.

Furthermore, regulated firms which are about to enter competitive environments may be less inclined to be forthcoming about their expectations of future cash flows and how they intend to maintain market share in the face of competitive inroads. Information that they may have provided regulators freely while operating as monopolies may be of strategic importance and, therefore be held more closely as competition unfolds.

The event study approach to merger assessment is attractive because it seems to offer a chance to short-circuit these problems and arrive at unbiased estimates of various quantities, based not on the representations of interested parties but on the aggregate wisdom of financial market participants. As one standard text on regulation puts it:

> ...market values of regulatory assets can provide one of the cleanest tests of regulatory effects on profits. (Joskow and Rose 1989)

In particular, if an event study shows that the announcement of a merger results in an increase in the combined market capitalization of the merging firms, we may conclude that the merged company is expected to be worth more than the two companies separately. In a regulatory context, depending on the institutional, legal, and political requirements that must be met for the merger to be approved, this may suggest a number of additional conclusions:

- the merger produces net economic benefits;
- shareholders will, in aggregate, benefit from the merger;
- the merger may affect competition in a particular way; and,
- a ratepayer sharing mechanism may be legally required.

Moreover, event study analysis is likely to be well-suited to the analysis of merger announcements in regulated industries. Many regulated firms are relatively large and have

their stocks widely traded; as a consequence, they are likely to be followed by a number of well-informed analysts. Despite any reticence they may have about revealing fundamental information on operating characteristics and stocks, regulated industries are compelled to disclose publicly a large amount of financial information. All these are factors that can contribute to the operation of a relatively efficient market.

4.2. Complicating Factors

Notwithstanding the attractiveness of the event study approach in regulated industries, a number of complicating factors make interpretation of the results difficult. Some of these factors are present to a greater or lesser extent in any use of the event study approach to merger analysis; others are particular to its use in regulated industries.

4.2.1. Noise

As set out above, when performing an event study it is vital to control for extraneous factors. This is likely to be particularly important in a regulatory context. Network industries are in transition; they are going through an uncertain period of change to a more competitive environment. This makes application of the standard event study methodology more difficult. Since the "market model" must be estimated over a period in the past, using it to predict the price change on the day of the event, absent the event, assumes that the underlying characteristics of the stock price determination process have not recently changed; this may not always be the case.

Furthermore, the transitional nature of regulated industries may make the market's assessment of the economic benefits of a merger less accurate. The market has substantial experience with evaluating the economic effect of mergers in, for example, the steel industry; it does not have similar experience in the electricity or local telephone industry. This does not nullify the validity of the EMH; the market's estimate is still the best unbiased estimate available. But its application to deregulating industries may not be as reliable as in other industries.

4.2.2. Mergers Involving Conglomerate Companies

Another problem with using the event study approach for regulatory purposes is that the firms involved may not be entirely in the regulated sector, either at the time of the event or in the future. Suppose we wish to estimate for regulatory purposes the economic benefits associated with a utility merger. The merger is between two holding companies, each of which owns a regulated utility. We are interested only in the economic benefits associated with the regulated utilities. However, the event study analysis will provide an estimate of the economic benefits associated with the holding companies, including benefits in parts of the companies that are not regulated. It will not normally be possible to separate out the different effects, because all or none of the expected benefits could be due to the regulated business.

This problem may arise even if the holding companies currently have no unregulated businesses at all. If the merger is expected to have an impact on unregulated activities that the merging companies plan to undertake, but have not yet begun, the market value of the merging firms could increase even though the firms are currently operating only in the regulated sector. The merger between two Regional Bell Operating Companies (RBOCs) discussed below is a good example. With the passage of the Telecommunications Act of 1996, these firms will be able to enter the long-distance market, and a substantial proportion of any market reaction to a merger involving an RBOC is likely to relate to anticipated

synergies in the long-distance market; a market in which they currently do not operate.

4.2.3. Changes in the Probability of the Merger Being Consummated

An announcement of a merger is not a fact; it merely states an intention which is frequently subject to review by both the merging companies' managements, their shareholders and government agencies. There may be some probability that the merger will not be consummated. This is particularly true in regulated industries, since the merger process tends to be longer and more complex than in others. The market's implicit assessment of the probability of a merger does not move from zero immediately before the announcement to one immediately after. It will move from a low level, (possibly greater that zero reflecting the market's perception that two companies were a particularly good fit or to leaks), to a higher level (less than one because of possible cancellation of the merger). These figures will obviously differ between mergers; for example, the SBC-PacTel merger came as a surprise to the market, so it may not be too inaccurate to assume that the probability did indeed move from near zero to close to one on the announcement. The announcement of the merger between NYNEX and Bell Atlantic, on the other hand, was less of a surprise since knowledge of merger discussions was public before the actual announcement.

4.2.4. Market Reaction Incorporates Expectations of Regulatory Action

A final point is that regulatory actions will have an impact on the change in the market valuation of *both* companies. For instance, expectations that there will be a rebate to ratepayers can reduce the increase in the price of the target stock. Recall that the EMH implies that the market price of a company's stock incorporates all publicly available information—including any information or expectations about likely regulatory actions. If a regulatory agency then seeks to use the market price of that company's stock in determining its actions, it will be using, as an input into its decision, a number which is itself influenced by investors' expectations regarding that decision. Clearly, this renders significantly more complex the problem of deriving information useful to regulators from financial market data.[20]

5. A Case Study: The SBC Communications/Pacific Telesis Merger

While the theory underlying event study analysis is simple and elegant, the practice is complex and riddled with pitfalls. To illustrate our argument, we proceed to a case study of the recent telecommunications merger between SBC and PacTel. In this case, intervenors seeking to draw conclusions from movements in stock prices made a number of errors. We contrast their analysis with our own assessment of the situation, referred to as the NERA/Grundfest Event Study.[21]

---

20 See, for example, McLaughlin and Mehran (1995), which finds that regulation reduces both the frequency of success of hostile takeovers and the excess returns to shareholders of target companies. However, their sample runs from 1980-90, a time when, as they put it, "public utilities in the United States operate[d] under rate of return regulation."

21 This study is the supporting analysis upon which Joseph A. Grundfest based his opinions expressed in the Rebuttal Testimony of Joseph A. Grundfest, *In the Matter of the Joint Application of Pacific Telesis Group and SBC Communications, Inc.* before the Public Utilities Commission of the State of California, Application No. 96-04-038, October 15, 1996.

5.1. Effect of the Merger Announcement on Stock Prices

On April 1, 1996, before the New York Stock Exchange had opened, SBC and PacTel announced their intention to merge. SBC was a RBOC which had 1995 revenues of $12.6 billion, a book value of $22.0 billion and a market capitalization (stock price times number of shares outstanding) of $32.1 billion. SBC Operating Companies provided telephone service in Arkansas, Kansas, Oklahoma, Texas, and Missouri. In addition, SBC provided cellular service in several cities outside its service territories under the Cellular One brand. It owned parts of several telecommunications ventures in other countries including a 10 percent stake in Telefonos de Mexico. On the basis of 1995 total revenue, SBC ranked fifth among the seven RBOCs.

PacTel, on the basis of 1995 total revenue of $9.0 billion, was the smallest of the RBOCs. Its total assets were $15.8 billion in 1995 and its market capitalization was $11.9 billion. Its major local exchange operations were in Nevada and California. It did not provide any wireless service at the time, even within its own service territory, having spun off these assets in 1994 into AirTouch Communications. On the other hand, PacTel had won auctions for the right to provide personal communication service (PCS) throughout California.

The merger was to be effected by a tax-free exchange of stock with PacTel shareholders receiving 0.733 of a share of SBC stock for every share of PacTel stock. On the last trading day before the merger announcement, PacTel stock closed at $27.75 while that of SBC closed at $52.625. At the SBC March 29 price, a share of PacTel stock was worth $38.57. On April 1, PacTel stock price closed at $33.75, or an increase of 21.62 percent over the previous trading day's close. The value of PacTel, as determined by its equity value, had risen by almost $2.6 billion in one day.

SBC stock, on the other hand, declined in value on the day of the announcement, closing at $49.875. Its market capitalization dropped by $1.675 billion. The impact on the companies when considered together was to increase the capitalization of the combined company by $896 million, meaning that the equity value of the two firms together rose by about two percent. Meanwhile, on the same day, the S&P 500 Index rose by 8.23 points or 1.27 percent, while an index composed of the other five publicly traded RBOCs rose by 4.59 percent.

This information is summarized in table 2.

5.2. Intervenors' Arguments

Under Section 854(b) of the California Public Utilities Code, ratepayers must receive "at least 50 percent of the economic benefits of a merger, acquisition or disposition of a California public utility." Intervenors in this case, relying on some of the arguments set out above, used the rise in Pacific Telesis' share price as the basis for estimating the size of such benefits. For example, one intervenor witness argued on behalf of the Office of Ratepayer Advocates (ORA):

> The estimated economic benefits for the broader definition of Section 854b is the merger premium paid to PTG [Pacific Telesis Group] shareholders for the ratepayer assets. The merger premium is calculated as the difference between the post- and pre-merger announcement market value of the PTG shareholder equity.[22]

22 Testimony of Bradford Cornell on behalf of the Office of Ratepayer Advocates, *In the Matter of the Joint Application of Pacific Telesis Group and SBC Communications Inc.* before the Public Utilities Commission of the State of California, Application No. 96-04-038, September 30, 1996.

Table 2. Stock Market Statistics for Pacific Telesis and SBC Merger Announcement				
	PacTel	SBC	S&P 500	RBOC Index
Price on March 29	$27.75	$52.625	645.50	130.95
Price on April 1	$33.75	$49.875	653.73	136.95
Percentage (%) Change	21.62%	-5.23%	1.28%	4.34%
Shares Outstanding* (million)	428.40	609.36	n/a	n/a
Market Capitalization ($ million) on March 29	11,889.00	32,067.57	n/a	n/a
Market Capitalization ($ million) on April 1	14,460.00	30,381.80	n/a	n/a
Change	$2,571.00	-$1,685.77		
Aggregate Change in Market Capitalization ($ million) of PacTel and SBC:				
In Dollars:	$885 million			
As a Percentage:	2.01%			
*Shares Outstanding for SBC changed on April 1, 1996 to 609.16 million shares. The Market Capitalization for SBC on April 1 reflects this change.				

However, instead of calculating this difference using PacTel's actual share price, as traded on the New York Stock Exchange after the merger announcement, this witness used SBC's post-merger announcement share price, times the exchange ratio of 0.733, to compute a value of a share of PacTel's outstanding equity after the announcement. He argued as follows:

> [T]he goal is to calculate the value of the ratepayer assets under the assumption that the merger succeeds. Following the announcement of the proposed merger, the market would not assume that the merger would definitely succeed. Consequently, the market discounts PacTel's stock price to reflect the possibility that the merger would fail. Including this discount in my calculations would be an error. The correct estimate is the implicit post merger announcement market value of PacTel based on the merger exchange ratio.[23]

On this basis, this witness calculated that the value of PacTel's equity would increase by $3.77 billion if the merger proceeded, and he therefore estimated the economic benefits to be $3.13 billion, after correcting for assets used in the unregulated business.

Similarly, another witness, on behalf of Toward Utility Rate Normalization (TURN), testified that:

> Another potential means of estimating the benefit of the merger is to analyze the value that PacTel shareholders attributed to the proposal. The total benefit that shareholders perceive as obtaining from a merger is reflected in the change in PacTel stock value when the merger was announced.[24]

Based on average share prices in the week before and after the merger, this witness estimated the benefits to be $2.6 billion, similar to the $2.57 billion shown in table 2.

---

23 See Cornell Testimony, *opt. cit.*

24 Testimony of Terry L. Murray on behalf of Towards Utility Rate Normalization, *In the Matter of the Joint Application of Pacific Telesis Group and SBC Communications, Inc.* before the Public Utilities Commission of the State of California, Application No. 96-04-038, September 30, 1996.

5.3. Analysis

Intervenors' methodology in this case was flawed in a number of ways. In particular:

- Both focused on Pacific Telesis' share price alone. As explained above, this cannot measure the economic benefit of the merger, only the gains to PacTel shareholders.
- Neither attempted to control for price movements in either the broader equity market or the telecommunications sector.
- The TURN witness did not attempt to separate out gains within the regulated portion of PacTel's business. The ORA witness did attempt this, but did so using an asset-based allocation, which – as set out above – is highly unlikely to correspond to the actual allocation of economic benefits. This is especially the case since a motivation for the merger was to improve the future competitiveness of a PacTel/SBC move into the long-distance market, where they currently have few assets, but where many or most of the economic benefits of the merger may arise.
- While TURN's witness was correct in arguing that the analysis should consider the probability that the merger is not consummated, his methodology was incorrect and internally inconsistent. He argued that PacTel's post-announcement stock price was an underestimate of the value of PacTel stock if the merger proceeds, because there is some chance that the merger will not proceed. If this were correct then, by the same logic, the post-announcement stock price of SBC is an overestimate of the value of SBC stock if the merger proceeds.

5.4. NERA/Grundfest Event Study

In response to these analyses, NERA performed an event study of the SBC/PacTel merger. In particular, we were interested in determining whether or not the announcement of the merger had a material impact on the combined value of the company. The study used, as the key dependent variable, the combined market capitalization of the two companies while controlling for broader market movements. Three separate and distinct market models were used; these models were constructed by regressing the combined market capitalization of PacTel and SBC on:

- the S&P 500 Index;
- the market capitalization of the other five publicly traded RBOCs; and,
- both the S&P 500 and the market capitalization of the other five publicly traded RBOCs.

It may be appropriate to put less weight on the models that include the share prices of the other RBOCs as an explanatory variable for SBC and PacTel's share prices, on the grounds that causation may have operated in reverse. In particular, the merger announcement may have caused the rise in the share prices of the other RBOCs by increasing the perceived likelihood that they, too, would be involved in merger or takeover.

A further issue in performing an event study of this type is the period over which the regression should be estimated. Normally, a period prior to the event of interest is used. However, in the case of a merger, it could be argued that the merger itself alters the process determining the stock prices of the two companies; therefore, a period *after* the merger announcement should be used. No definitive answer to this question exists. Each model was estimated twice, once by each method. In fact, the difference between the two approaches was not substantial in this case.

Summary regression results are shown in table 3.

5.4.1. Results

Each model yields a separate prediction of the change in the combined market capitalization of PacTel and SBC, absent any company-specific news. The difference between this predicted return and the actual return (that is, the "excess" return) may be attributed to the company-specific news released in the relevant time period; here, the merger announcement.

These results are shown in column 5 of table 3. The estimated one-day excess return of the combined entity using the various models varied between 1.1 percent and -1.25 percent. In four of the six models, estimated one-day excess returns were negative. If statistically significant, a negative result would indicate that the market's evaluation of the merger was negative. It might also indicate that whatever the market's estimate of the benefits that may arise out of the merger, the CPUC was expected to impose conditions on the merger that would result in more than the benefits of the merger flowing to ratepayers.

As discussed above, it is sometimes argued that excess returns should not be calculated over just one day but over a somewhat longer period, to reflect the fact that it may take financial markets some time to fully incorporate news into their expectations of future profits and, hence, into stock prices. This may well be the case in this instance, given the size and complexity of the PacTel/SBC merger proposal. Excess returns over the trading week April 1 to April 8, 1996 are shown in column 8 of table 3. Here, the five-day excess returns are negative for *all* the models estimated, varying between -1.0 and -2.1 percent.

5.4.2. Statistical Significance of Results

If the change in market capitalization on the date of the merger announcement is not significantly greater than that observed on an "ordinary" trading day, it would clearly be incorrect to make any inferences based upon the price change. Therefore, we also report t-statistics on table 3 for the one-day excess returns and the five-day cumulative excess returns on the market capitalization of PacTel and SBC. For *none* of the six models did either the one-day or the five-day excess return yield any significant positive excess return.

The failure of the merger announcement to have a statistically significant effect on the combined market capitalization of the merging companies is evident in table 4. There we report the 95 percent confidence intervals for the combined market capitalization of PacTel

Table 3. PacTel-SBC Merger Announcement Event Study: April 1, 1996

Model*	Estimated Coefficient on RBOC 5	Estimated Coefficient on S&P 500	R^2	1-Day Excess Return (percent)	1-Day Market Value Reaction ($ millions)	t-stat	5-Day Excess Return (percent)	5-Day Market Value Reaction ($ millions)	t-stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	——	0.965	0.23	0.81%	362.09	0.77	-2.02%	-865.16	-0.85
2	0.723	——	0.52	-1.25%	-546.18	-1.49	-1.21%	-519.59	-0.64
3	0.650	0.270	0.54	-1.25%	-543.90	-1.51	-1.17%	-502.38	-0.63
4	——	0.741	0.31	1.10%	488.41	1.30	-2.05%	-882.26	-1.08
5	0.629	——	0.53	-0.83%	-361.89	-1.19	-1.34%	-578.10	-0.86
6	0.521	0.329	0.57	-0.75%	-329.30	-1.13	-1.42%	-616.84	-0.95

Notes and Sources:

*The above model is based upon a regression of log returns of the aggregate market capitalization of PacTel and SBC on the log returns of the S&P 500 Index, the RBOC 5 Index, or both the S&P 500 Index and the RBOC 5 Index. Models 1, 2, and 3 use the period from 4/3/95 to 3/29/96 for the regression. Models 4, 5, and 6 use the period from 4/8/96 to 8/30/96 for the regression.

and SBC at the close of trading on the day of the merger announcement, and five trading days later. Figure 1, which presents the same material in graphical form, shows that the actual post-announcement market capitalization remains well within the 95 percent confidence interval throughout this period.

Figure 1 shows this result in more detail. It shows, for Model 1, the paths of the actual and predicted market capitalizations of PacTel and SBC immediately after the merger announcement. The symmetric dotted lines mark the border of statistical significance at the 95 percent level. If the actual value of the two companies fell outside either dotted line, then we would infer a statistically significant event,[25] all else being equal and there being no additional considerations. Similar figures for the other models would also show no statistically significant price reaction over any length of time from one to five days. That is, the actual price trajectory would always lie within the 95 percent confidence interval.

Normally, an event study of this type would not analyze stock prices more than five trading days after the event of interest. However, we undertook an analysis to confirm the above results over a longer period of time to account for the small possibility that the market took a substantial amount of time to absorb fully the relevant information about the merger. Following the same procedure used to analyze the five-day stock price changes, we estimated 95 percent confidence intervals for the market capitalization on September 30, 1996, six months after the merger announcement. Again, we found that the value of the firm was not significantly different from what any of our models predicted it would have been.

Table 4. PacTel-SBC Merger Announcement Event Study: April 1, 1996

	1-Day Market Value Reactions ($ millions)			5-Day Market Value Reactions ($ millions)		
Model*	95% Confidence Interval: Lower Bound	Actual Market Value	95% Confidence Interval: Upper Bound	95% Confidence Interval: Lower Bound	Actual Market Value	95% Confidence Interval: Upper Bound
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	43,560	44,841	45,415	41,784	42,904	45,868
2	44,667	44,841	46,160	41,858	42,904	45,051
3	44,673	44,841	46,148	41,859	42,904	45,014
4	43,619	44,841	45,094	42,193	42,904	45,450
5	44,601	44,841	45,838	42,172	42,904	44,832
6	44,594	44,841	45,776	42,266	42,904	44,811

Notes and Sources:
*All models are based upon a regression of log returns of the aggregate market capitalization of PacTel and SBC on the log returns of the S&P 500 Index, the RBOC 5 Index, or both the S&P 500 Index and the RBOC 5 Index. Models 1, 2, and 3 use the period from 4/3/95 to 3/29/96 for the regression. Models 4, 5, and 6 use the period from 4/8/96 to 8/30/96 for the regression.

25 In other words, there would be a less than 1 in 20 probability of the observed value of the two companies lying outside the band bordered by the dotted line if the merger had no impact.

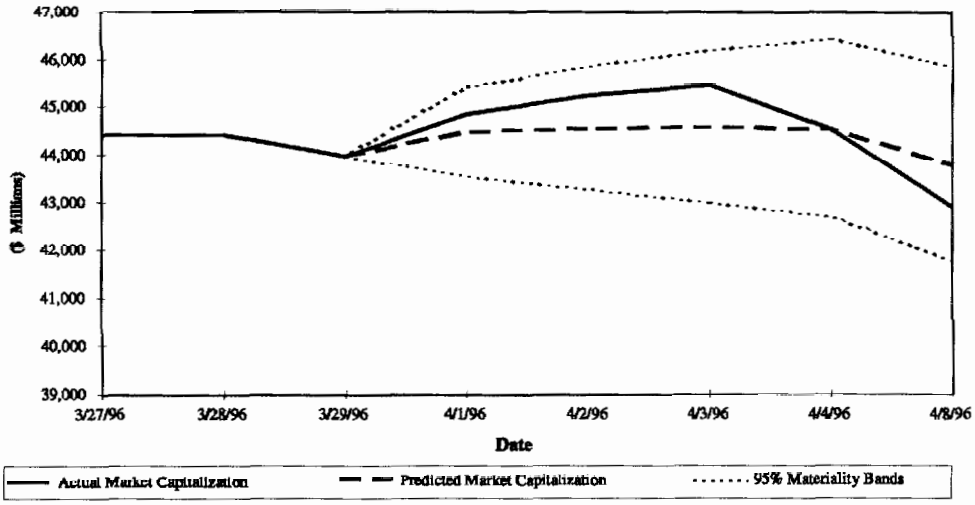

Figure 1. Pacific Telesis and SBC Communications, Inc. Actual and Predicted Combined Market Capitalization with 95% Materiality Bands—Model 1, April 1, 1996

5.4.3. Probability Merger Will Proceed

We have already pointed out that it is indeed theoretically correct to take account of the probability that the merger does not proceed. We examined the likely significance of this probability by examining the change in the relative movement of SBC and PacTel stock prices. Before the merger announcement, the stock prices of PacTel and SBC moved together to some extent, but by no means one-for-one. Indeed, in the year preceding the merger announcement, the ratio of PacTel's share price to SBC's share price fluctuated widely, varying between 0.5 and 0.74. After the merger announcement, but before the merger had achieved its last major regulatory approval, the two stock prices moved virtually in tandem, with the ratio fluctuating in a very narrow band between 0.67 and 0.70. This suggests that the market attached a very high probability to the merger proceeding as planned. The commentary provided by analysts and the business press appeared to confirm this assessment. Therefore, we did not attempt to estimate this probability econometrically and incorporate it into our results, since the effects would have been minimal.[26]

5.4.4. Conclusion

The NERA/Grundfest event study of the effect of the merger announcement on the combined market capitalization of PacTel and SBC concluded that the announcement *had no statistically significant effect*. This conclusion was consistent over a variety of different models used to calculate excess returns, and for a variety of different time periods after the announcement.

This does not permit us to conclude that there are no economic benefits to shareholders, since there is a substantial amount of uncertainty attached to any such estimate. Depending

26 One possible technique for implementing this procedure is described in McGuckin, Warren-Boulton, and Waldstein (1992).

on the model chosen—which is a matter of judgement—the best estimate of economic benefits to shareholders could range from -$882 million to $488 million, with a wide margin of error. However, financial market data do not permit us to conclude that the economic benefits of this merger to shareholders differ significantly from zero.

5.5. Effect of the California Public Utility Commission Final Decision

An interesting footnote to our event study of the SBC/PacTel merger is provided by the market reaction to the March 31, 1997 decision of the CPUC to approve the merger, subject to a rebate of $248 million to customers over the next five years. This final decision had been preceded by a proposed decision written by the administrative law judges who conducted the regulatory hearings. They alleged economic benefits from the merger of $1.181 billion.[27] The proposed decision contained a requirement that $590.5 million be rebated to ratepayers. The proposed decision required that the present value of this amount, adjusted by an inflation factor of 10 percent per year, be paid for the five years following the completion of the merger.

5.5.1. Event Study of the CPUC Announcement

We performed a similar analysis of the market reaction to the CPUC's announcement of its final decision. The one-day price reaction was positive and significant at the 95 percent level under a number of specifications of the model, although not all. Details are shown in table 5. Again, we are inclined to put most weight on the simple market model (based on the S&P 500), which suggests that the announcement had a significant and positive impact on the market value of SBC/PacTel.

5.5.2. Possible Interpretations

There are at least two possible interpretations of this result:

- The rebate to ratepayers imposed by the PUC was less than expected by the market. The original proposed decision of the ALJs was to impose a rebate of $590 million, that would have amounted to more than $660 million (in 1997 dollars) after the required inflation adjustments.[28] The actual rebate imposed by the PUC was substantially less, $248 million. This could explain a substantial amount of the market reaction on March 31.
- The decision removed any remaining uncertainty that the merger would be consummated. Note that a positive economic impact as of March 1997 would not necessarily be inconsistent with our prior conclusion that the economic benefits of the merger expected as of April 1, 1996 were relatively small. By March 1997, the managements of the two companies had invested a substantial amount of time and energy in securing regulatory approval of the merger, taking preliminary steps towards implementing the merger, and in developing business strategies based on the assumption the merger would proceed. Therefore, as of the March 31 date, a decision by the PUC to block the merger might indeed have generated substantial economic costs to the companies.

---

27 Proposed decision of Administrative Law Judges Malcolm and Econome, February 21, 1997, p.31.
28 This number assumes an actual inflation rate of three percent per year.

Table 5. PacTel-SBC CPUC Approval Announcement Event Study: March 31, 1997

Model*	Estimated Coefficient on RBOC 5	Estimated Coefficient on S&P 500	R^2	1-Day Excess Return (percent)	1-Day Market Value Reaction ($ million)	t-stat	5-Day Excess Return (percent)	5-Day Market Value Reaction ($ million)	t-stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	——	0.965	0.23	3.33%	1,605.44	3.13	1.98%	958.78	0.83
2	0.723	——	0.52	0.79%	375.81	0.94	1.25%	605.68	0.67
3	0.650	0.270	0.54	1.44%	687.75	1.74	1.78%	856.04	0.96
4	——	0.883	0.23	3.12%	1,504.71	2.52	1.66%	807.99	0.60
5	0.800	——	0.62	0.74%	354.56	0.86	1.40%	675.98	0.72
6	0.743	0.206	0.63	1.24%	591.56	1.44	1.79%	861.39	0.93

Notes and Sources:

*The above model is based upon a regression of log returns of the aggregate market capitalization of PacTel and SBC on the log returns of the S&P 500 Index, the RBOC 5 Index, or both the S&P 500 Index and the RBOC 5 Index. Models 1, 2, and 3 use the period from 4/3/95 to 3/29/96 for the regression. Models 4, 5, and 6 use the period from 9/27/96 to 3/27/97 for the regression.

6. Further Case Studies

In order to further illustrate the correct application of the event study technique, we present below a case study involving another merger proposed between two telecommunications companies, in somewhat less detail than that of PacTel/SBC above.[29]

6.1. MCI Communications/British Telecom Merger

On November 4, 1996, British Telecom (BT), the largest British telecommunications operator, and MCI Communications (MCI), the second largest US long distance company, announced their intention to conclude a full merger. A review of an event study performed for the two companies' stocks highlights many of the possible interpretations that can be suggested by an event study and underscores some of the potential pitfalls.

6.1.1. Timing Issues

MCI stock trades on the NASDAQ while BT stock trades on the London stock exchange with American Depository Receipts (ADRs)[30] traded on the NYSE. Although MCI and BT had already undertaken joint ventures, the market did not learn of their merger discussions until the afternoon, Eastern Standard Time (EST), of November 1, 1996. At MCI's request, NASDAQ halted trading of MCI stock at approximately 1:35 PM EST, by which time the London market had already closed. The formal announcement of merger discussions did not occur until November 4, 1996. Table 6 contains a summary of the companies' stock prices during this time period.

As noted before, the proper method of quantifying a merger's economic benefits to

29 The longer version of this paper, available from the authors, also contains a case study of the Puget Sound Power & Light merger with Washington Energy Company.

30 American Depository Receipts are certificates that are issued by financial institutions that hold the underlying stock. They are created for the purposes of trading the stock of non-United States companies on United States exchanges.

Table 6. MCI Communications and British Telecom Stock Prices—10/31/96 to 11/4/96

Date	MCI Communications[a]	BT ADR's[b]	BT London[c]
	(U.S. Dollars)	(U.S. Dollars)	(U.S. Dollars)
(1)	(2)	(3)	(4)
10/31/96	25.125	57.625	57.847
11/1/96	30.188	55.500	57.325
11/4/96	30.750	61.625	61.414

Notes and Sources:
[a]From FactSet Data Systems, Inc.
[b]One BT ADR traded on the New York Stock Exchange represents 10 ordinary shares traded in the London market.
[c]The British Telecom shares trading in London have been converted into the equivalent value of British Telecom's U.S. ADRs. The British Pound/U.S. Dollar exchange rate was obtained from FactSet Data Systems. Prices may differ between U.S. and London due to different market closing times.

shareholders requires evaluating the aggregate market capitalization of the two merging firms. The market capitalization of BT may be measured by multiplying either its London share price or its US ADR price by the number of shares outstanding. The trans-national nature of this merger provides an interesting trading chronology. The problem of disjoint trading hours can be seen clearly by comparing the stock price movements of both the BT ADRs in the U.S. and the BT shares in London. Note that when they trade simultaneously, BT ADRs and BT shares in London will trade at almost exactly the same price (when converted to a common currency) since it is possible to arbitrage the two markets.

The delayed movement in the BT London price was simply due to the fact that trading was closed in London when the news of the merger discussions became public, while the spreading of the MCI price reaction over two days reflects the suspension of trading in MCI shares on November 1. Any event study of the BT-MCI merger must deal with this issue of timing. We therefore use a two-day price reaction rather than a one-day reaction in this case.

6.1.2. Results

On October 31, 1996, the approximate market capitalization of MCI was $17.2 billion and the approximate market capitalization of BT was $36.3 billion. At the close of trading on November 4, 1996, the market capitalizations of MCI and BT were $21.1 billion and $38.8 billion, respectively. This is clearly an increase in absolute market capitalizations; however, one must recall that movements in the wider market must be accounted for. In this case, three distinct market models were considered by regressing the "returns" of the combined market capitalization of MCI and BT on:

- the S&P 500 Index;
- the FTSE-100 Index; and,
- both the S&P 500 and the FTSE-100.

We estimated the market model over the period October 31, 1995 to October 31, 1996. The regression results, one-day excess returns, and five-day excess returns are summarized in table 7. It is apparent that markets believed that the merger would result in substantial economic benefits to shareholders. All three regression models yield strongly significant and positive two-day and five-day market value reactions. The two-day and five-day market reactions are approximately $6.4 billion and $3.4-4.7 billion, respectively. A $6.4 billion dollar reaction is approximately a 12 percent increase in the combined market value as of October 31, 1996.

Table 7. MCI-British Telecom Merger Announcement Event Study: November 1, 1996

Model*	Estimated Coefficient on S&P 500	Estimated Coefficient on FTSE-100	R^2	2-Day Excess Return (percent)	2-Day Market Value Reaction ($ million)	t-stat	5-Day Excess Return (percent)	5-Day Market Value Reaction ($ million)	t-stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	0.606	——	0.14	11.23%	6,361.98	7.25	6.09%	3,375.97	2.49
2	——	0.665	0.14	11.42%	6,476.16	7.39	8.43%	4,719.42	3.45
3	0.494	0.545	0.22	11.37%	6,441.56	7.73	6.95%	3,863.73	2.99

Notes and Sources:

*The above models are based upon a regression of log returns of the aggregate market capitalization of MCI and BT on the log returns of the S&P 500 Index, the FTSE-100 Index, or both the S&P 500 Index and the FTSE-100 Index. The time period used in the regression was from 10/31/95 to 10/31/96. The data used for the market capitalization and the S&P 500 was obtained from FactSet Data Systems, Inc. The data on FTSE-100 was obtained from Bloomberg, L.P. and converted to U.S. dollars using a daily ($/Pound sterling) exchange rate.

6.1.3. Interpreting the Results: Efficiency/Synergy or Collusion?

Markets clearly concluded that the shareholders of this new merged entity would gain substantially. This positive market movement encompasses the probability of the merger's success, the prospects for its competitors, and the expected future of the global telecommunications industry. As discussed previously, the positive reaction does not necessarily imply that the merger means increased efficiency and increased consumer welfare. We attempted to examine these issues by looking at the stock price reactions of other telecommunications companies that might potentially compete with the merged BT-MCI.

The United States telephone companies most comparable with MCI experienced substantial increases in their stock prices on November 1, 1996. This includes Sprint Corp., LCI International Inc., Teleport Communications Group Inc., and Frontier Corp. For example, Sprint's stock price increased by 11.1 percent. Market comment indicated that this reaction primarily reflected increased speculation that these other "comparable" telecommunications firms could also become targets of a merger. This could suggest that markets are forecasting further consolidation in the global telecommunication industry. However, it tells us little directly about the competitive impact of the BT-MCI merger.

To assess this competitive impact, it would be preferable to look at the likely competitors with the merged BT-MCI. This means larger telecommunications companies such as AT&T and the European telecommunications monopolies. However, some of the latter do not have publicly traded stock. Shares in Deutsche Telekom were first offered publicly on November 18, 1996, shortly after the BT-MCI merger announcement, while France Telecom remains state-owned.

Three companies which might be considered competitors, Cable & Wireless PLC, Telefonica de España, and Nippon Telegraph & Telephone, do have U.S. ADRs; thus, their stock price reactions can be calculated as of November 1, 1996. As stated previously, if these companies exhibit statistically significant, negative price reactions, one might view this as evidence that a BT-MCI merged entity will, in fact, have increased efficiency and competitiveness, hence reducing competitors' profits.

As shown in table 8, the market model used in each regression differed according to the location of each company's primary market exchange. All the estimated models used the period from October 31, 1995 to October 31, 1996 as the "clean" period. Table 8 also

includes the regression results, the one-day excess returns, and the five-day excess returns. Since the stocks and ADRs were all traded in the United States and there was no suspension in trading for these companies, a one-day price reaction has been calculated in place of a two-day reaction.

Although three of the four competitor firms have negative one-day market value reactions, only Telefonica de España's negative reaction is significant at the 95 percent level. Examining the five-day price reactions yielded a similar result. Again, three of the four companies had negative price reactions; however, none of these reactions were significant. In both instances where the price reactions were positive, the corresponding t-statistics fail to indicate significance. The price reactions of the BT-MCI competitors cannot be used to distinguish between competitive efficiencies or collusive profits as the explanation for BT-MCI's substantial positive stock price reaction.

6.1.4. Conclusion

On the whole, this case study reveals that the market unambiguously forecasted an economic benefit to the shareholders of a merged BT-MCI. In regulatory environments where shareholder benefits are a relevant consideration, it seems clear that regulators would be justified into taking such benefits into account. While these benefits may or may not materialize, the best unbiased estimate of such benefits at the time of the merger announcement was large and positive. However, it is less clear whether the expected source of such benefits is efficiency savings or greater market power; the examination of the impact of the news on competitors and comparables is ambiguous.

7. Conclusion

The Efficient Markets Hypothesis has made an important technique available to the analysts of regulated industries. Event study analysis can be a useful and powerful tool in the analysis of mergers in regulated industries, when correctly applied. It offers a number of advantages over conventional approaches. However, it should be used with care; it is easy to use an

Table 8. Stock Price Reaction of Possible MCI-BT Competitors on November 1, 1996

Stock/ADR	Index	Estimated Coefficient on Index	R^2	1-Day Excess Return (percent)	1-Day Price Reaction ($)	t-stat	5-Day Excess Return (percent)	5-Day Price Reaction ($)	t-stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Telefonica de España	S&P 500	0.471	0.09	-2.15%	-1.28	-2.04	1.23%	0.77	0.52
Cable & Wireless PLC	FTSE-100	0.841	0.07	1.88%	0.46	0.92	-0.08%	-0.01	-0.02
Nippon Telegraph & Telephone	Nikkei 225	0.132	0.00	-2.51%	-0.99	-1.81	-3.09%	-1.09	-0.84
AT&T	S&P 500	0.901	0.07	-0.95%	-0.32	-0.41	-1.33%	-0.42	-0.26

Notes and Sources:

The above models are based upon a regression of log returns of the stock price or ADR price on the log returns of the specified index. The FTSE-100 Index and the Nikkei 225 Index were converted into U.S. dollars. The time period used in the regression was from 10/31/95 to 10/31/96. The data on stock prices and exchange rates was obtained from FactSet Data Systems, Inc. The data on the FTSE-100 and the Nikkei 225 was obtained from Bloomberg, L.P.

event study to jump to conclusions that may not be supported by the underlying facts. Potential pitfalls range from the simple, such as the use of the stock price of only the firm being taken over, rather than both firms, to the more subtle, such as the importance of accounting for potential developments in the unregulated sectors of a firm's future business.

In this paper, we have shown how event study analysis can be used and abused, both from a theoretical and an empirical perspective. We have attempted to show how the theory can usefully be applied through two recent case studies. It is our expectation that, as regulators adopt more market-based approaches to industry oversight, regulation based on market judgements—including judgements made by financial markets—will become more prevalent, and that the event study analysis will become an increasingly important tool.

References

Bradley, M., A. Desai, and E. Kim 1983. "The Rationale Behind Interfirm Tender Offers: Information or Synergy?" *Journal of Financial Economics* 11: 183-206.

Brealey, Richard A., and Stewart C. Myers 1995. *Fundamentals of Corporate Finance*. New York: McGraw Hill.

Cornell, Bradford, and R. Gregory Morgan 1990. "Using Finance Theory to Measure Damages in Fraud in the Market Cases." *UCLA Law Review* 37: 883-912.

Dickey, Jonathan C., and Marcia Kramer Mayer 1996. "Effect on 10b-5 Damages of the 1995 Private Securities Litigation Reform Act: A Forward-Looking Assessment." *Business Lawyer* 51 (August).

Eckbo, B. Espen 1983. "Horizontal Mergers, Collusion, and Stockholder Wealth." *Journal of Financial Economics* 11: 241-273.

Fama, Eugene F. 1965. "The Behaviour of Stock Market Prices." *Journal of Business* 38: 34-105.

Fama, Eugene F., Lawrence Fisher, Michael Jensen, and Richard Roll 1969. "The Adjustment of Stock Prices to New Information." *International Economic Review* 10(1): 1-21.

Giaccotto, C., and Sfiridis, J. 1996. "Hypothesis Testing in Event Studies: The Case of Variance Changes." *Journal of Economics and Business* 48: 349-370.

Gibson, Ronald J., and Bernard S. Black. 1995. *The Law and Finance of Corporate Acquisitions*. Foundation Press, 2d edition.

Joskow, P., and N. L. Rose. 1989. "Effects of Economic Regulation." *Handbook of Industrial Organization* 2:1450-1506.

Keim, D.B. 1986. "The CAPM and Equity Return Regularities." *Financial Analysts Journal* 42: 19-34.

Malkiel, Burton G. 1987. "Efficient Market Hypothesis." In *The New Palgrave: A Dictionary of Economics*. London: MacMillan Press.

McLaughlin, Robert H., and H. Mehran 1995. "Regulation and the Market for Corporate Control: Hostile Tender Offers for Electric and Gas Utilities." *Journal of Regulatory Economics* 8: 181-204.

McGuckin, Robert H., Peter Waldstein, and Frederick R. Warren-Boulton 1992. "The Use of Stock Market Returns in Antitrust Analysis of Mergers." *Review of Industrial Organization* 7:1-11.

Roberts, H. 1967. "Statistical versus Clinical Prediction of the Stock Market." Unpublished manuscript. University of Chicago: Center for Research on Securities Prices.

Rose, N. L 1985. "The Incidence of Regulatory Rents in the Trucking Industry." *Rand Journal of Economics* 16: 299, 318.

Werden, G.J., and M.A. Williams. 1989. "The Role of Stock Market Studies in Formulating Antitrust Policy Towards Horizontal Mergers." *Quarterly Journal of Business and Economics* 28: 3-21.